

The Split-Brain Debate Revisited: on the Importance of Language and Self-Recognition for Right Hemispheric Consciousness

by
Alain Morin*

Abstract: In this commentary I use recent empirical evidence and theoretical analyses concerning the importance of language and the meaning of self-recognition to reevaluate the claim that the right mute hemisphere in commissurotomed patients possesses a full consciousness. Preliminary data indicate that inner speech is deeply linked to self-awareness; also, four hypotheses concerning the crucial role inner speech plays in self-focus are presented. The legitimacy of self-recognition as a strong operationalization of self-awareness in the right hemisphere is also questioned on the basis that it might rather tap a preexisting body awareness having little to do with an access to mental events. I conclude with the formulation of an alternative interpretation of commissurotomy according to which split-brain patients exhibit two uneven streams of self-awareness - a "complete" one in the left hemisphere and a "primitive" one in the right hemisphere.

1. Introduction

Much has been written about the psychological and philosophical implications of commissurotomy since the publication of Gazzaniga, Bogen and Sperry's classic paper in 1962 (see also Sperry, 1964). The main debate has revolved around the question of conscious unity in split-brain patients, and many conflicting interpretations have been proposed (for a review, see Natsoulas, 1987, 1988, 1991, 1992, 1993). These range from views according to which only the left hemisphere is self-aware (DeWitt, 1975; Eccles, 1970; Popper and Eccles, 1977) to the position that commissurotomy creates dual consciousness (Sperry, 1968, 1984), and include the intermediate view to the effect that it literally divides consciousness (MacKay, 1966). More extreme positions have been put forward as well - for instance, even the normal brain would possess dual consciousness (Bogen, 1969) and personhood (Puccetti, 1973, 1981, 1988).

The way one will interpret the split-brain data largely depends upon one's view of what consciousness is (Hardcastle, 1993). Terms like "consciousness", "self-con-

*Mount Royal College, Alberta, Canada, E-mail: amorin@mtroyal.ab.ca. First published in *Journal of Mind and Behavior*, Spring 2001, Vol. 22, No. 2, 207-118.

consciousness", "personal identity", "mind" and "person" have been interchangeably used in the literature; to avoid any further confusion, let me clarify right from the outset what I will be talking about in this article. By "consciousness" I will mean "self-awareness" - the ability to become the object of one's own attention and to acquire self-information (Duval and Wicklund, 1972). Thus a cerebral hemisphere possessing self-awareness knows that it exists (it has a "sense of self") and is capable of identifying, processing and storing information about its current subjective experience. Self-awareness in that sense refers to "second-order consciousness" or "reflective awareness".

Another important point is that the understanding of commissurotomy relies on one's conception of the role language plays in self-awareness. Obviously, those who think that the right mute hemisphere possesses a full sense of self also believe that language is of no importance to self-awareness. This view has taken many different forms in the past. Natsoulas (1987, p. 437) summarizes this position as follows:

Human awareness and verbal analysis are two things; the first is not reducible to the second. Therefore, verbal analysis is unnecessary for consciousness of a human kind, and a disconnected right hemisphere may be conscious in this way though, on its own, it lacks linguistic abilities.

It is precisely this notion that I wish to examine in this article, by presenting empirical evidence and theoretical analyses that do suggest that language is important to self-awareness. Also, recent discussions indicating that self-recognition (of which the isolated right hemisphere is capable of) might represent a poor operationalization of self-awareness will be taken into account. I will thus propose that since the right disconnected hemisphere lacks linguistic abilities it cannot be fully self-aware. This in turn will motivate me to articulate an alternative interpretation of commissurotomy.

2. Self-awareness in the absence of language

I begin with a crucial qualification: language is *not* a necessary condition for self-awareness. It would be inaccurate to say that the right hemisphere of split-brain patients is deprived of *any form* of self-awareness. Anecdotal observations support this claim - for instance, it is extremely difficult to maintain that left hemispherectomized patients, certain stroke victims, deaf-mutes, and prelinguistic children are mindless automatons. One must recognize that many routes can lead to self-awareness. The social environment represents an important source of self-information: we learn much about ourselves through reflected (verbal and non-verbal) appraisals we get from other persons (Cooley, 1912); people frequently comment on, or react to, our behaviors and

personal characteristics; this feedback enriches our self-concept and may trigger self-observation (especially when the information does not fit our current self-schematas). Also, confrontations with other ways of thinking, feeling, or behaving motivate us to take other persons' perspective and to develop an objective vision of ourselves (Mead, 1934) and to examine our own intellectual, emotional, and behavioral patterns. Furthermore, social stimuli (e.g., the presence of an audience) are known to initiate self-awareness by reminding the individual of his or her object status for others (Carver and Scheier, 1978). The right hemisphere might be aphasic but it has nonetheless been repeatedly exposed to a social environment.

At a more cognitive level, other strategies besides language can be used by the self to gain access to its subjective experience. Imagery, for example, can be viewed as an important cognitive process leading to self-awareness (Morin, 1998). Research has shown that highly self-conscious people (who frequently focus on the self) report using imagery as a means of introspection (Turner, Scheier, Carver, and Ickes, 1978). I propose that imagery is capable of internally reproducing social mechanisms responsible for self-awareness. One such mechanism is the opportunity to see oneself as one is seen by others (Mead's thesis), which leads to an objective vision of oneself. Imagery internalizes this social mechanism because mental images empower us to literally see ourselves acting (or having behaved) in given ways as others could see (or have seen) us acting. When one mentally sees oneself behaving in a given fashion, one is self-aware; furthermore, when one reflects on past behaviors by using mental images, one can deduct aspects of one's past functioning from what is internally seen - that is, one can acquire self-information and build a self-concept. I assume here that the right disconnected hemisphere (which is specialized in *visuospatial* tasks) uses imagery, possibly as a tool for introspection.

3. *The importance of inner speech*

Thus I agree with Natsoulas (1987) and others that the right mute hemisphere has some form of self-awareness. But my contention is that language *does* make a big difference and allows for the creation of a much more sophisticated form of self-awareness. In the split-brain literature the advocates of the importance of language remain remarkably vague. Popper and Eccles (1977, p. 553) state that "... the origin of the self-conscious mind somewhat goes together with the origin of language". DeWitt (1975, p. 42) claims that "... the presence of language marks the difference between the presence of self-consciousness and the complete absence of any awareness of self". Dennett (1991) introduces the notion of a "center of narrative gravity" to describe what the right hemisphere lacks. And Weiskrantz (1997) argues that patients with self-awareness deficits - e.g., blindsight, numbsense, amnesia, prosopagnosia, unilateral

neglect and anosognosia - can no longer "comment" on their defective skill; such commentary (language) would thus be crucial for self-awareness.

I would like to suggest that it is not language per se that should be linked to self-awareness, but rather, it is the capacity to talk to oneself - that is, inner speech (Morin, 1995a). Inner speech has been extensively studied as a psychological phenomenon in its own right; it is actively involved in many basic human activities such as self-regulation, problem-solving, planning, and memory (see Zivin, 1979, for a review). Although in what follows I will exclusively focus on the notion that self-awareness greatly depends upon self-talk, it should be acknowledged that the relationship is likely to be bidirectional. Inner speech itself also depends upon self-awareness, or at least consciousness: one needs to be awake and conscious in order to talk to oneself; furthermore, without a conscious subjective experience the self would not have much to talk about.

Informal clinical observations illustrate the hypothesis of a link between inner speech and self-awareness. Moss (1972), a clinical psychologist who suffered from a stroke but recuperated from aphasia, relates his experience:

The second week [at the hospital] I ran into a colleague who happened to mention that it must be very frustrating for me to be aphasic since prior to that I had been so verbally facile. [I] later found myself why it was not. I think part of the explanation was relatively simple. If I had lost the ability to converse with others, I had also lost the ability to engage in self-talk. In other words, I did not have the ability to think about the future - to worry, to anticipate or perceive it - at least not with words. Thus for the first four or five weeks after hospitalization *I simply existed*. So the fact that I could not use words even internally was, in fact, a safeguard (p. 10; italics added).

Ojemann (1986) treated patients suffering from cortical damage:

As recovery occurs, conscious experience returns as well. It seems to return in parallel with the phenomenon of inner speech. Inner speech may be limited, restricted, concrete, foggy, not normal after these kinds of lesions, but at least conscious experience has come back (p. 161).

Preliminary empirical evidence also supports the idea of a relation between inner speech and self-awareness. In three independent studies, a significant positive correlation has been found between validated measures of inner speech and "self-consciousness" - the natural disposition to focus on the self more or less frequently (Morin, Everett, Turcotte, and Tardif, 1993; Rivest and Khawaja, 1995; Siegrist, 1995). Siegrist (1996) also found that highly self-aware individuals use inner speech more

frequently in comparison to less self-aware individuals. This suggests that the more one focuses on the self the more one talks to oneself about oneself.

This gains even more credibility when one realizes that inner speech and self-awareness share a common neurological basis (Morin, 1999). The neurological substrate of inner speech has been known for quite a while - most experts agree that it is the left inferior frontal region. Very recently, Craik, Moroz, Moscovitch, Stuss, Winocur, Tulving, and Kapur (1999) identified the brain areas involved in self-awareness. They measured brain activity in normal subjects who were working on a self-referential encoding task. Participants were requested to judge how well trait adjectives described themselves by pressing response keys while relative regional cerebral blood flow was being measured. This task clearly measures self-awareness since it involves thinking about oneself. Control tasks consisted in three non self-referential exercises - judging how well trait adjectives described a public figure, how socially desirable the trait adjectives were, and how many syllables there were in each adjective. Results show that the self-referential encoding task produced an increased activity in the left medial aspect of the superior frontal gyrus and in the left inferior frontal gyrus.

So my point is that since inner speech and self-awareness seem to share a common neurological basis, these two operations must be deeply linked. What then, could be the nature of this link? Why would inner speech be important for self-awareness? At least four arguments can be put forward (see Morin, 1993, 1995a). First, as does imagery, self-talk can reproduce Mead's and Cooley's social mechanisms contributing to self-awareness. More precisely, when we talk to ourselves, we can incorporate other persons' potential views of ourselves in our self-talk and gain an objective vision of ourselves which facilitates self-observation. For example, one might say to oneself: How did I look when I gave my conference? I remember seeing John looking at me. I wonder what he thought about it [taking others' perspective / objective vision of oneself]. Well, overall my presentation wasn't too bad [acquisition of self-information] - but God I was nervous [acquisition of self-information]! John probably perceived this! But I spoke loud enough [acquisition of self-information], and I made people laugh on a couple of occasions [acquisition of self-information].

Mead (1934) proposed that talking to oneself could give rise to a fictional dialogue where verbalizations of an objective, and thus different point of view about ourselves could be possible. The child can only see himself or herself from the perspective of another, and he or she can at first only take this perspective on himself or herself by describing his or her activity to the other and so calling out in himself or herself the implicit response of another to his or her description. In this perspective, one function of private speech in early childhood would be to make young speakers aware of their actions and of their own separate existence.

We can also address comments to ourselves about ourselves, as others do toward us. In other words, inner speech can internalize an interpersonal mode of acquisition of information (verbal appraisals made by others about ourselves) - thus becoming an intrapersonal mode of acquisition of self-information. Second, with self-talk we can "translate" self-information into a verbal representation. By doing so we create a redundancy, since self-information (e.g., an emotion of joy) and its verbal representation (e.g., "I am happy!") are different. This redundancy in turn creates a distance (essential for self-observation) between any potential bit of self-information and the individual (the self). Third, the process of acquisition of self-information (self-awareness) can be seen as a problem ("Who am I?"; "How did I behave in this situation?"), and inner speech can greatly help solve this problem by defining it, articulating a fruitful strategy, focusing attention on the problem, and reinforcing oneself (when a solution is reached) or readjusting one's strategy (when difficulties arise). And fourth, inner speech allows the use of a rich vocabulary about oneself that helps to differentiate subtle physiological sensations or emotional responses and deepens self-understanding. For example (from Morin, 1995a), one may say to oneself: "I feel sad... , I feel very sad". Or one may rather say to oneself: "I feel sad... , I'm *disappointed, discouraged* I feel *bitter*". Obviously, in the second example, one will gain a more sophisticated understanding of one's emotional experience.

We are in a better position now to fully appreciate the importance of inner speech for self-awareness: the mute right hemisphere lacks a powerful cognitive tool to adequately identify, process and store information about its subjective experience or any other self-aspect. Natsoulas (1991) observed that Gillett's (1987) position regarding the role of verbal abilities in consciousness is vague - Gillett proposes, without explaining why, that "propositional attitudes" (that I take to be inner speech) are necessary for a full (self-) consciousness. Although, as stated previously, I believe that some self-awareness is possible without language, I hope the present analysis clarifies the question. Natsoulas asks (p. 22) about Gillett's view, "Are we to conclude that the disconnected right hemisphere, deficient as it is in linguistic abilities, cannot experience love or hate (which counts against this hemisphere's having a stream of consciousness)?" Certainly it can experience an emotion; but without inner speech I suggest that it might not clearly *know* that it is experiencing it. *Reflecting on one's* emotions will be difficult, because I believe that verbal labels are very useful in adequately identifying emotions; without language, emotional responses (or physiological sensations, attitudes, values, goals, etc.) are likely to be more "diffuse" or "out of focus". People better understand their emotional experiences when they talk to themselves (or to others) about them. By extension, people develop a more sophisticated self-concept when they frequently engage in self-talk (see Morin, 1995b). One could compare inner speech to a flashlight used to find one's way through a gloomy room: without the light one will still be capable of approximate perception (and one can use touch to detect

furniture and objects in the room); but perception will be much more vivid and precise if one puts the flashlight on.

4. *The significance of self-recognition*

One important observation that has been frequently mentioned to support the idea of full self-awareness in the right hemisphere is the fact that the right hemisphere is capable of self-recognition (Sperry, Zaidel, and Zaidel, 1979). Self-recognition in front of a mirror is typically used to tap the existence of self-awareness in primates (see Gallup, 1968, 1985, 1998) and young children (see Amsterdam, 1972). The basic reasoning is that to recognize oneself one must know who one is - one must possess a self-concept; also, emitting self-directed behaviors in front of a mirror indicates that one is capable of becoming the object of one's attention - the very definition of self-awareness.

Sperry et al. (1979) used a special device allowing the lateralized presentation of pictures to two split-brain patients. Both subjects were able with their right hemisphere to recognize, select and identify from among neutral items in a choice array, pictures of themselves, their family, relatives acquaintances, pets, belongings and also political, historical and religious figures and personalities from the entertainment world.

Self-recognition as a valid operationalization of self-awareness had been criticized by Mitchell (1993) and more recently by Povinelli (1998). Both argue that self-recognition might actually be correlated with a very primitive self-concept, and does not presuppose the existence of introspective skills. More precisely, Mitchell proposes that what the organism recognizes in front of a mirror is its *body*, by matching the image it sees in the mirror with a preexisting kinesthetic representation of it. Thus the only awareness the organism would have of itself before self-recognition is a kinesthetic sense of its body - not an awareness of its mental events or any other private self-aspects. As Mitchell explains:

Gallup (1987, p. 3) states that "An organism is self-aware to the extent that it can be shown capable of becoming the object of its own attention". In this definition, the term "it" is ambiguous, creating a confusion as to which sense of self-awareness is intended. If "it" means an organism's mental states, then the organism is self-aware in the first sense [it can be conscious of its thoughts or internal representations and experiences]; if "it" means an organism's personal history, qualities, looks, body, and mental states identified as the organism's own, then the organism is self-aware in the second sense [it can understand its personal history and attributes, motives, thoughts, actions, hopes, desires, and body identified as its own]; if "it" means the organism it-

self (i.e., the organism's body), then the organism is self-aware in a very limited sense (p. 22; my brackets).

Again, according to Mitchell, "it" refers to just that - the organism's body.

Povinelli's analysis (paragraph 22) is congruent with Mitchell's, except he thinks that what is recognized in front of a mirror is *behavior* emitted by the organism:

When chimpanzees and orangutans see themselves in a mirror, they form an equivalence relation between the actions they see in the mirror and their own behavior. Every time they move, the mirror image moves with them. They conclude that everything that is true for the mirror image is also true for their own bodies, and vice versa. Thus, these apes can pass the mirror test by correlating colored marks on the mirror image with marks on their own bodies. But the ape does not conclude, "That's me"! Rather the animal concludes, "That's the same as me"!

In other words, according to Povinelli, the animal infers that what it sees in the mirror is the same as what it does ("That's the same as *what I do*"); self-recognition does not mean the animal understands that what it sees is itself ("That's *me*").

He further maintains that primates that have been shown to be capable of self-recognition - and thus, presumably, of self-awareness - lack the ability to make inferences about others' mental states. Gallup has been arguing for years that chimpanzees and orangutans are self-aware not only because they show self-recognition, but also because they use deception and exhibit altruism and empathy in their natural environment. These behaviors are possible only if the animal has access to its own mental states and can ponder potential intentions in others or can reflect on how it feels to need help or to suffer. Gallup's (1983) typical illustration is this: to be able to infer that another chimpanzee is sad and lonely presupposes, from the part of the chimpanzee making such an inference, the awareness of what it is like to feel sad and lonely. Gallup provides anecdotal examples of gratitude, grudging, sympathy, empathy, reconciliation, attribution, deception, and sorrow in wild primates, but Povinelli presents contrary evidence to the effect that in *controlled* experiments primates are incapable of inferring mental states in others. In one experiment, for example, chimpanzees (who were successfully tested for self-recognition) were allowed to beg for food from two experimenters - one that could see the chimps and another one who could not. Gallup would expect the chimps to gesture only to the person who could see them because having experienced what it is like not to see (i.e., having been self-aware), the chimps should infer that a blindfolded experimenter is having the same experience. But contrary to this prediction, all subjects were just as likely to gesture to the person who could not see them as to the person who could.

Similar results obtained in other experiments, together with Mitchell's and Povinelli's reinterpretations of the meaning of animals' behavior in front of mirrors, cast doubts on the notion that self-recognition represents a legitimate indicator of self-awareness. Sperry et al. - and many other researchers - might have overestimated the level of self-awareness in the right disconnected hemisphere. To paraphrase LeDoux (1985), the conscious status of the language-deficient isolated right hemisphere might be, well, more like that of a chimpanzee than a human being.

5. *A compromise*

What can we conclude at this point? I submit the following interpretation of the split-brain data - a blend of more extreme positions that have been proposed in the past. Commissurotomy *unevenly* divides self-awareness: the left hemisphere (because of language) maintains a level of self-awareness comparable to the one it had before commissurotomy; the right hemisphere is self-aware, but at a very primitive level, like that of prelinguistic children or apes. (Note that one can argue that these two unequal streams of self-awareness could be transitory [see Dennett, 1991] or elicited only under specific experimental conditions [see Marks, 1981].) Other views resemble the one presented here (for example, see Eccles' final interpretation of commissurotomy, 1980, 1981; also Mortensen, O'Brien, and Paterson, 1993) but I believe that the present proposal is unique for two reasons. First, previous interpretations suggest that commissurotomy either creates two full streams of consciousness, produces two "half-consciousnesses", or has no effect on consciousness (the right isolated hemisphere being "unconscious"). My position is that two unequal streams of consciousness (i.e., self-awareness) emerge out of the transection of the forebrain commissures. Second, this analysis incorporates empirical evidence (1) regarding the importance of language (i.e., inner speech) for self-awareness, and (2) concerning the legitimacy of self-recognition as an operationalization of self-awareness.

To my knowledge the only (convincing) case of real full double self-awareness in a split-brain patient has been observed in the well documented case P. S. (Gazzaniga, LeDoux, and Wilson, 1978). This patient most likely had early brain injury in the left hemisphere at the age of two; the consequence of this insult was to bilaterize the language process. As a result, the right hemisphere of P. S. possessed unusual verbal abilities. I suggest that this hemisphere also exhibits unusual levels of self-awareness in comparison to the right hemisphere of split-brain patients without bilateral representation of speech. This raises an intriguing possibility: maybe P. S. not only possesses two separated streams of self-awareness, but also two independent streams of inner speech - two concurrent but different self-conversations.

References

- Amsterdam, B. (1972), "Mirror self-image reactions before age two", *Development Psychobiology*, 5, 297-305.
- Bogen, J.E. (1969), "The other side of the brain II: an appositional mind", *Bulletin of the Los Angeles Neurological Society*, 34, 135-162.
- Carver, C.S., and M.F. Scheier (1978), "Self-focusing effects of dispositional self-consciousness, mirror presence, and audience presence", *Journal of Personality and Social Psychology*, 36, 324-332.
- Cooley, C.H. (1902), *Human Nature and the Social Order*, New York: Scribners.
- Craik, F., T. Moroz, M. Moscovitch, D. Stuss, G. Winocur, E. Tulving, and S. Kapur (1999), "In search of the self: a positron emission tomography study", *Psychological Science*, 10, 26-34.
- Dennett, D.C. (1991), *Consciousness Explained*, Boston: Little Brown.
- DeWitt, J. (1975), "Consciousness, mind and self: the implications of split-brain studies", *British Journal of the Philosophy of Sciences*, 26, 41-47.
- Duval, S., and R.A. Wicklund (1972), *A Theory of Objective Self-Awareness*, New York: Academic Press.
- Eccles, J.C. (1970), *Facing Reality*, New York: Springer-Verlag.
- Eccles, J.C. (1980), *The Human Psyche*, Berlin: Springer-Verlag.
- Eccles, J.C. (1981), "Mental dualism and commissurotomy", *The Behavioral and Brain Sciences*, 4, 105.
- Gallup, G.G. Jr. (1968), "Mirror-images stimulation", *Psychological Bulletin*, 70, 782-793.
- Gallup, G.G. Jr. (1983), "Toward a comparative psychology of mind", in: R.L. Mellgren (ed.), *Animal Cognition and Behavior*, New York: North Holland, 473-510.
- Gallup, G.G. Jr. (1985), "Do mind exist in species other than our own?", *Neuroscience and Biobehavioral Reviews*, 9, 631-641.
- Gallup, G.G. Jr. (1998), "Can animals emphathize? Yes" [29 paragraphs], *Scientific American* (Feature article - Animal self-awareness: a debate), <http://www.sciam.com/1998/1198intelligence/1198debate.html>.
- Gazzaniga, M.S., J.E. Bogen, and R.W. Sperry (1962), "Some functional effects of sectioning the cerebral commissures in man", *Proceedings of the National Academy of Sciences*, 48, 1765-1769.
- Gazzaniga, M.S., J.E. LeDoux, and D.H. Wilson (1978), "Language, praxis, and the right hemisphere: clues to some mechanisms of consciousness", *Neurology*, 27, 1144-1147.
- Hardcastle, V.G. (1993), "A new agenda for studying consciousness" [9 paragraphs], *Psychology* [Online serial], 4 (57), <http://www.ai.univie.ac.at/archives/Psycology/1993.V4/0056.html>.
- LeDoux, J.E. (1985), "Brain, mind and language", in: D.A. Oakley (ed.), *Brain and Mind*, London: Methuen, 197-216.
- MacKay, D.M. (1966), "Cerebral control and the conscious control of action", in: J.C. Eccles (ed.), *Brain and Conscious Experience*, 422-444.
- Marks, C.E. (1981), *Commissurotomy, Consciousness and Unity of Mind*, Cambridge, Massachusetts: MIT Press.
- Mead, G.H. (1934), *Mind, Self, and Society*, Chicago: University of Chicago Press.
- Mitchell, R.W. (1993), "Mental models of mirror-self-recognition: two theories", *New Ideas in Psychology*, 11, 295-325.
- Morin, A. (1993), "Self-talk and self-awareness: on the nature of the relation", *The Journal of Mind and Behavior*, 14, 223-234.
- Morin, A. (1995a), "Characteristics of an effective internal dialogue in the acquisition of self-information", *Imagination, Cognition and Personality*, 15, 45-58.

- Morin, A. (1995b), "Preliminary data on a relation between self-talk and complexity of the self-concept", *Psychological Reports*, 76, 267-272.
- Morin, A. (1998), "Imagery and self-awareness: a theoretical note" [10 paragraphs], *Theory and Review in Psychology* [On-line journal], <http://www.gemstate.net/susan/>.
- Morin, A. (1999), "On a relation between inner speech and self-awareness: Additional evidence from brain studies" [7 paragraphs], *Dynamical Psychology: an International, Interdisciplinary Journal of Complex Mental Processes* [On-line journal], <http://goertzel.org/dynapsyc/>.
- Morin, A., and J. Everett (1990), "Inner speech as a mediator of self-awareness, self-consciousness, and self-knowledge: an hypothesis", *New Ideas in Psychology*, 8, 337-356.
- Morin, A., J. Everett, I. Turcotte, and G. Tardif (1993), "Le dialogue intérieur comme médiateur cognitif de la conscience de soi privée: une mesure de l'activité consistant à se parler à soi-même à propos de soi et une étude corrélationnelle [Self-talk as a mediator of private self-consciousness: A measure of the activity to talk to oneself about oneself and a correlational study]", *La Revue Québécoise de Psychologie*, 14, 3-19.
- Mortensen, C., G. O'Brien, and B. Paterson (1993), "Distinctions: subpersonal and subconscious" [10 paragraphs], *Psychology* [On-line serial], 4(62), <http://www.ai.univie.ac.at/archives/Psycology/1993.V4/0061.html>.
- Moss, V.V. (1972), *Recovery with Aphasia*, University of Illinois Press: Illinois.
- Natsoulas, T. (1987), "Consciousness and commissurotomy: I. Spheres and streams of consciousness", *The Journal of Mind and Behavior*, 8, 435-468.
- Natsoulas, T. (1988), "Consciousness and commissurotomy: II. Some pertinencies for intact functioning", *The Journal of Mind and Behavior*, 9, 515-548.
- Natsoulas, T. (1991), "Consciousness and commissurotomy: III. Toward the improvement of alternative conceptions", *The Journal of Mind and Behavior*, 12, 1-32.
- Natsoulas, T. (1992), "Consciousness and commissurotomy: IV. Three hypothesized dimensions of deconnected left-hemispheric consciousness", *The Journal of Mind and Behavior*, 13, 37-68.
- Natsoulas, T. (1993), "Consciousness and commissurotomy: V. Concerning an hypothesis of normal dual consciousness", *The Journal of Mind and Behavior*, 14, 179-202.
- Popper, K.R., and J.C. Eccles (1977), *The Self and its Brain: an Argument for Interactionism*, Berlin: Springer International.
- Povinelli, D.J. (1998), "Can animals empathize? Maybe not" [30 paragraphs], *Scientific American* (Feature article - Animal self-awareness: a debate), <http://www.sciam.com/1998/1198intelligence/1198debate.html>.
- Puccetti, R. (1973), "Brain bisection and personal identity", *British Journal of the Philosophy of Sciences*, 24, 399-345.
- Puccetti, R. (1981), "The case for mental dualism: Evidence from the split-brain data and other considerations", *Behavioral and Brain Sciences*, 4, 93-123.
- Puccetti, R. (1988), *The Enigma of the Encephalon*, Department of Philosophy, Dalhousie University (unpublished manuscript).
- Rivest, C., and S. Khawaja (1995), *Dialogue intérieur et conscience de soi [Internal dialogue and self-consciousness]*, Département de Psychologie, Université du Québec à Trois-Rivières (unpublished manuscript).
- Siegrist, M. (1995), "Inner speech as a cognitive process mediating self-consciousness and inhibiting self-deception", *Psychological Reports*, 76, 259-265.
- Siegrist, M. (1996), "The influence of self-consciousness on the internal consistency of different scales", *Personality and Individual Differences*, 20, 115-117.
- Sperry, R.W. (1964), "The great cerebral commissure", *Scientific American*, 210, 42-52.

- Sperry, R.W. (1968), "Hemisphere disconnection and unity of - in - conscious awareness", *American Psychologist*, 23, 723-733.
- Sperry, R.W. (1984), "Consciousness, personal identity, and the divided brain", *Neuropsychologia*, 22, 661-673.
- Sperry, R.W., E. Zaidel, and D. Zaidel (1979), "Self-recognition and social awareness in the disconnected minor hemisphere", *Neuropsychologia*, 17, 153-166.
- Turner, R.G., M.S. Scheier, C.S. Carver, and W. Ickes (1978), "Correlates of self-consciousness", *Journal of Personality Assessment*, 42, 285-289.
- Weiskrantz, L. (1997), *Consciousness Lost and Found: a Neurophysiological Exploration*, Oxford: Oxford University Press.
- Zivin, G. (1979), *The Development of Self-Regulation Through Private Speech*, New York: Wiley.